Energy Innovations Small Grant Program

Stages And Gates Process

Executive Summary
California Energy Commission
Stages and Gates Process

Introduction

The Public Interest Energy Research (PIER) Program is committed to advancing science and technology and to deliver benefits of such to California electricity ratepayers and the citizens of California in general. The best way to do this is to establish processes that will increase the probability of the results of the RD&D to reach the California market place. The Stages and Gates Process is designed to:

- Provide discipline that increases the probability of success of the project
- Lead to a higher percentage of successful projects in the portfolio
- Improve the contract manager's ability to meet project objectives on time and within budget by emphasizing the completion of numerous activities *simultaneously* by those contributing to the project.
- Enhances communication within the Commission and with our stakeholders by providing a common language and set of terms
- Improves decision making about project continuation by contract managers and Commission management by providing clear transparent criteria for decision making

The Stage Gate Process is an eight-stage method of logical thought and decision making for use by California Energy Commission (Commission) contract managers, its partners, PIER teams, contracts, legal, auditing, PIER Program Area Leads, the RD&D Committee, and the Commission in researching, developing, and demonstrating new technologies and products. It is a project-based process that aids in the development (and commercialization) of new products, i.e., hardware, software, information, and processes, for the citizens of California. While originally designed for the PIER Program, the process is broad enough to cover market transformation activities as well.

The Stage Gate Process is built on a foundation of best practices from the RD&D community across the country. It integrates three parallel, but interdependent streams of activities - technical, business, and administrative - needed to develop a product from its initial conception through RD&D and to market launch and the ultimate market place. These activities are integrated such that progressively better information about the project and the product - market potential, customers' needs and wants, public benefits and costs, and technical feasibility - are provided at each stage of the process. Administrative activities support the RD&D Process by providing linkages for requests for proposals, proposal terms and conditions, and other processes.

The Stage Gate Process derives its strength from the integrated application of diverse skills in a structured framework. Improved effectiveness, efficiency, and productivity in the execution of key project tasks and faster, more informed decision-making processes are the result of the period checkpoints, or gates, built into the process.

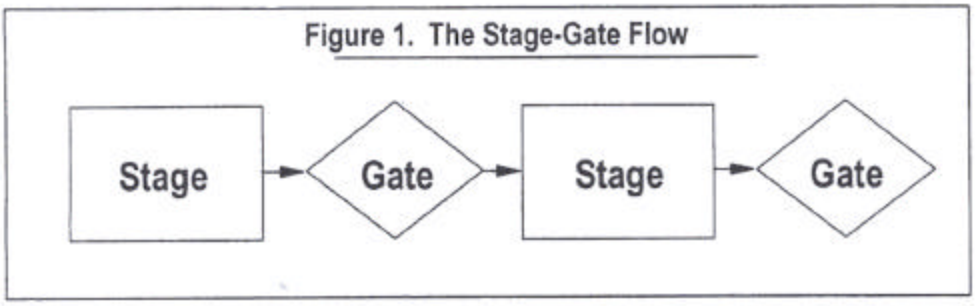
Stages and Gates

The stage gate process incorporates the following attributes of successful projects:

- Customers' needs were recognized early, and RD&D was targeted at satisfying these needs
- Winning products were technically superior and featured strong product uniqueness
- Winning products provided significant value to the customer

- Competitors' solutions were well understood, and every effort was made to provide a superior product in areas **important to the customer**.

The building blocks of the RD&D process are stages and gates. The RD&D process is a series of stages punctuated by decision points or gates, as illustrated in Figure 1. Each stage is a set of concurrent activities performed by project contributors. Gates are checkpoints at which the contributors and Commission decision makers (or "gatekeepers") decide to go forward with the project, go back to resolve key issues, or stop it permanently.



Stages

Stages are where analytical and developmental work is performed. The near-term objective of each stage is to accumulate the information needed to convince the gatekeepers to make an appropriate decision at the next gate. Each stage is designed to make technical progress and gather the information needed to move the project to the next gate or decision point and to future gates.

Gates

Gates are decision points. Each gate has the following specification:

- A set of required information from the preceding stage which is reviewed by the gatekeepers
- A set of criteria to judge the merits and progress of the project
- A decision on whether the project should go ahead or be stopped
- Approval or release of funds (at critical gates)
- A path forward for the next stage

Each gate has its own set of quantitative and/or qualitative criteria for deciding whether the project should be continued into the next stage. These criteria are agreed upon in advance by the project contributors and the gatekeeper(s) for that gate. The evaluation criteria help to answer the following questions:

- Does the project have the potential to offer public benefits to California's electricity ratepayers in excess of public costs? What is the ratio of public to total (public and private) benefits? Is match funding commensurate with the level of private benefits?
- Have intellectual property issues been resolved?
- Does the concept still have strong potential for being a marketable product? Is a commercializer committed to bringing this product to the California market place if it is technically successful?
- Does the project advance science and technology? Would it be conducted without PIER funding?
- Does the product concept still fit with PIER Program strategies, goals, objectives, program area issues, and current project portfolio?

- Have essential activities been completed at the proper level of detail? Is the project on time and within budget? Have key criteria been met since the previous gate? Is the project still capable of meeting technical specifications? Should the project be continued to the next stage of development? Should it be terminated?
- Are there any regulatory (e.g., environmental or safety), market, or business "showstoppers" or unacceptably high risks that have been identified? Can the project overcome these risks? Is a quality control plan in place to handle them?

Gate Decisions

The emphasis of the RD&D process is on the gates. Gate decisions are more than project milestones. They address multiple technical and business issues on a project at a given point in time. Moreover, they are the key decision points at which a project's future is decided. Either a "Go Forward", "Stop", or "Go Back" (and get more definitive data) decision is made at each gate.

Projects given a "Go Forward" to proceed to the next gate are essentially proceeding on track with minimal or no modification in approach. These projects have met the decision criteria at the gate. The decision to "Go Forward" includes acceptance of work done to date as well as work to be performed in the next stage. All Stage Gate Process stages and gates are shown in Table 1.

Table 1. Commission RD&D Process Stages and Gates

Stages	**Gates**
• Stage 1 - Idea Generation and Work Statement Development	• Gate 1 - Idea Selection and Work Statement Approval
• Stage 2 - Technical and Market Analysis	• Gate 2- Research Approval
• Stage 3 -Research and Bench Scale Testing	• Gate 3 - Proof of Feasibility
• Stage 4 - Technology Development & Field Experiments	• Gate 4 - Product Development Initiation
• Stage 5 - Product Development & Field Testing	• Gate 5 - Demonstration Initiation
• Stage 6 - Demonstration and Full- Scale Testing	• Gate 6 - Market Transformation Initiation
• Stage 7 - Market Transformation	• Gate 7 - Commercialization Initiation
• Stage 8- Commercialization	• Gate 8 - Completion Review

Description of the Eight Stages

Stage 1 - Idea Generation and Work Statement Development: The first stage involves defining customer needs, the market served, the technical idea or concept, and public benefits and costs. Proposal preparation is generally a part of this stage.

Stage 2 - Technical and Market Analysis: The second stage encompasses market research to determine market size and refine customer needs; technical analysis to define preliminary product specifications; and a refined analysis of environmental, safety, and other risks.

Stage 3 - Research and Bench Scale Testing: This stage involves testing of critical components and the full system at a bench or laboratory scale (for industrial and geothermal projects, the "lab" may be in the field). This is often called the "basic research" phase. The research culminates in a proof-of- feasibility test (Gate 3).

Stage 4 - Technology Development and Field Experiments: This stage covers designing, building, and testing a prototype, obtaining the commercializer's binding commitment to proceed, a draft production readiness plan, and documenting match funding.

Stage 5 - Product Development and Field Testing: This stage typically involves multi-unit field testing, including RAMD (reliability, availability, maintainability, and durability) testing, a refined production readiness plan from the commercializer, and resolving any remaining regulatory issues. This could be a sub-scale unit.

Stage 6 - Demonstration and Full-Scale Testing: This stage involves full-scale, real-world testing in a user environment to determine commercial feasibility.

Stage 7 - Market Transformation: This stage has the objective of removing the final barriers to the market. These barriers include unresolved regulatory issues, lack of information and training, lack of maintenance and service providers, performance uncertainties, rules of thumb, perception barriers, and other issues.

Stage 8 - Commercialization: This is the typical "product launch" phase, where the commercializer introduces the product to the market, and then proceeds to full commercialization

Gatekeepers

"Gatekeepers" are the decision maker(s) at each gate in the process. In most cases, the gatekeeper is the contract manager. For critical decisions, the PIER Program Area Lead, RD&D Committee, or other key resources like the Contracts Office may be involved.

The philosophy on decision-making is to keep decisions to the lowest level in the Commission management chain with the authority and responsibility to make the decisions. A decision maker or "gatekeeper" matrix is shown in Table 2.

Who is responsible for answering the questions of the gatekeepers? Generally, the contractor(s) will provide the answers in the work performed in the previous stage. Some questions, like on portfolio balance within the PIER Program Area, may have to be answered by the Commission contract manager or the PIER Program Area Lead.

Gate Number	Gate Name	Gatekeepers
1	Idea Selection and Work Statement Approval	Contract manager, contracts, legal, PIER Program Area Leader
2	Research Approval	Contract manager
3	Proof of Feasibility	Contract manager
4	Product Development Initiation	Contract manager PIER Program Area Leader, contracts
5	Demonstration Initiation	Contract manager
6	Market Transformation Initiation	Market Transformation Funder (Outside of PIER)
7	Commercialization	Manufacturer (outside of PIER)
8	Completion Review	PIER Program Area Leader

Table 2: Commission Stage Gate Process:

Discipline	Stage 1 Idea Generation and Work Statement Development	Gate 1 Idea Selection and Work Statement Approval
Marketing/ Connection to the Market	Define the end user market needs. Define public and electric ratepayer needs, including needs catalyzed by electric restructuring. Define the market served. Investigate other market studies. Define baseline market conditions. Develop the team needed for market analysis. Define the pathway to the market.	What general customer needs would the Concept serve? Why hasn't the market met these needs to date? What CA public/electric ratepayer needs would it serve? What CA issue(s) arising from electric restructuring can be addressed by advancement of this technology? What broad groups of users might the concept serve? What market analysis is available from other groups? Is it adequate or are other studies needed? Have baseline market conditions been adequately defined? Has the proper expertise been arranged and the project plan been developed for the market analysis? Has the pathway to the market been adequately delineated? What is it?
Engineering/ Technical	Define the concept (i.e., purpose, function, uses). Develop the team needed for technical analysis. Define baseline technical conditions (E.g., technical needs, competition). Delineate the plan for meeting technical needs, gaps, and challenges. Assess the state of the art of this concept.	What is the preliminary concept? What features would it have? What functions would it perform? Has the proper expertise and project plan been arranged for technical analysis? Have baseline technical conditions been adequately defined? Has an adequate technical plan been developed to meet technical needs'? What is it? Has anyone attempted to develop the concept? What are the results of past efforts? What is the state of the art of this concept?
Legal / Contractual	Address proprietary data needs. Determine whether or not the private or regulated sector is or would adequately funds this concept? Conduct preliminary patentability analysis including identifying pre-existing agreements and patents affecting IP and royalties. Identify required permits or certify that none are needed. Identify potential partners and obtain appropriate commitments for cost sharing or resources. Assess the ability o the contractor to conduct the project.	How will the Commission be able to acquire the proprietary market and technical information needed for the technical and market evaluation? Will this project be adequately funded by competitive or regulated markets? What funding mechanism should be used to encumber the funds? Is it likely the idea is patentable? Is there royalty potential for the PIER program? Are there unresolved IP issues? Have required permits been identified or certification that none are required been provided? Have commitments from partners for cost sharing or resources been obtained? Does the contractor and team have the ability to successfully conduct this project?
Environmental, Safety, other Risk Assessments/ Quality Plans	Identify known environmental and other risks and means for managing them.	Are there any perceived risks identified that might result from this concept? What are they? What is the plan for their mitigation?
Strategic	Evaluate fit with Commission PIER Program objectives, goals, other projects, portfolio mix, and program balance (e.g., short term vs. long term). Identify linkages to other PIER projects, including critical path analysis.	How does the concept fit with current PIER Program objectives, goals, the portfolio of projects, and in terms of program balance? Are there links to other PIER projects, either feeding into or coming from this concept critical to other PIER projects? Which ones?
Production Readiness/ Commercialization	Can this idea result in a near-term commercial product?	What type of company do we anticipate might commercialize this product?
Public Benefits/ Costs	Identify potential public costs and benefits. Identify benefits to all stakeholders (public and private). Calculate preliminary public benefit-cost ratio.	Will the R&D be beneficial to CA's electric ratepayers? If so, in what ways (cost; efficiency; non-economic benefits, e.g., comfort, environmental, reliability, safety)? What is the public value of the idea? The public cost? What is the preliminary public benefit-cost ratio? What is the ratio of public to total benefits?

Discipline	Stage 2 Technical & Market Analysis	Gate 2 Research Approval
Marketing/ Connection to the Market	Conduct needed market research and analysis to determine: ➢ Market size ➢ Customer needs ➢ Market segmentation ➢ Energy use Determine whether or not the need for the product is currently being met.	What specific market segments are being targeted? What is the potential CA market size? How have the customer's requirements been translated into product technical specifications?
Engineering/ Technical	Conduct technical analysis. Develop preliminary product specifications: ➢ Product design ➢ Reliability and maintainability ➢ Manufacturability Define the criteria for the technical feasibility test (in stage 3). Develop the test plan: ➢ Cost/price ➢ Regulatory compliance Obtain information on competing products (SWOT-Strengths, weaknesses, opportunities, and threats-analysis).	What technical gaps remain? What is general technical approach? What are the proposed scope, timing, and cost of the project? Are the criteria for the technical feasibility test adequate? What are they? Is it likely that the test plan will meet these criteria and prove feasibility? How does our product compare to the competition? What additional information has been obtained on competing products?
Legal / Contractual	Conduct refined patentability analysis. Obtain required permits.	What are the results of the refined patentability analysis? Are there any showstoppers? Have required permits been obtained?
Environmental, Safety, other Risk Assessments/ Quality Plans	Refine the analysis of environmental, safety, technical, market, and other risks and the means for managing them.	What are the refined environmental, safety, technical, market and other risks? How will they be resolved? Which risks are the most critical?
Strategic		
Production Readiness/ Commercialization	Identify potential commercializing partners and asses their capabilities. Conduct preliminary analysis of the (financial and other) ability of potential commercializer(s) to take the product to the market. Identify any additional potential stakeholders in the value chain that will need to be receive value in order for the product to reach the market.	Who might be the commercializer? What motivation do they have to bring this product to market? Does the potential commercializer have the financial and other stability to produce the product? Do the appropriable benefits justify the investment needed by stakeholders to bring this product to market?
Public Benefits/ Costs	Calculate the refined public benefit-cost ratio based on market analysis.	What is the refined public benefit-cost ratio? What are the potential environmental and safety benefits of the product? What are other non-economic (productivity, reliability, peak load reduction) public benefits can be accrued from the product?

Discipline	Stage 3 Research and Bench Scale Testing	Gate 3 Proof of Feasiblity
Marketing/ Connection to the Market		For the target market, What are the clarified customers needs and market potential estimates? What is the reaction of the targeted customers to the product specifications?
Engineering/ Technical	Refine technical product specifications considering cost / price and functional requirements. Test critical components and the full system in bench scale or lab tests. Develop criteria and test plan for field experiments (in stage 4).	What performance goals (product specifications) have been set for the product? What were the results of the technical feasibility test? Has the product met the technical feasibility criteria? Is there justification to proceed before solving the remaining technical problems? What is the justification? Is the test plan for field experiments adequate? Will it lead to satisfying the criteria identified?
Legal / Contractual	File patent or invention disclosure if needed. Identify new legal or patent issues. Develop a plan for their resolution. Obtain agreement from the commercializer to provide sales data to document benefits.	Is the patent or invention disclosure filed? Is it needed? What other legal patents issues have arisen? Is there a plan for their resolution? What is it? Has the commercializer agreed to provide the Commission with sales data?
Environmental, Safety, other Risk Assessments/ Quality Plans	Develop the quality plan: ➢ Reliability Analysis ➢ Failure Mode Analysis ➢ Manufacturability, cost, and maintainability analysis ➢ Hazard Analysis ➢ Coordinated Test Plan ➢ Product safety environment	What is the quality plan? How will selected elements of the plan reduce risks? What environmental and safety issues have arisen? How will they be resolved? Has a product life cycle analysis been conducted? Have any new risks been identified? What is the plan to resolve them?
Strategic		Has technology achievement been linked to PIER policy objectives? Does this product impact on other PIER projects? If so, how is the timing of the projects linked? Is this product critically dependent on other projects under development within PIER or elsewhere? If so, which project and has it reached technical feasibility?
Production Readiness/ Commercialization	Prioritize the list of potential commercializing partners and meet with them.	Who are the top candidates for commercializing partner? Has a commercializer been selected? What evidence exists of commercializing partner commitment?
Public Benefits/ Costs	Change public benefit-cost analysis based on results of the technical feasibility test.	Did the technical feasibility test change the public benefit-cost ratio? Do benefits still outweigh costs?

Discipline	Stage 4 Technology Development And Field Experiment	Gate 4 Product Development Initiation
Marketing/ Connection to the Market	With the commercializer, prepare a product marketing / technology transfer plan. When developing the production readiness plan, include a marketing strategy.	Has a product positioning strategy (e.g., Suppliers manufactures, distributors, customers) been developed? What is it and who are the players? What market's reactions to the product? How does the product meet the preliminary customers' requirements (e.g., function, features, and price? How does the production readiness plan incorporate a marketing strategy?
Engineering/ Technical	Design and build a prototype according to product specifications and cost goals from previous stages. Finalize a detailed field test plan (for stage 5) including RAMD (reliability, availability, maintainability, and durability) requirements. Select candidate sites for field-testing. Conduct laboratory or field experiments.	Are there any remaining technical issues and, if so, is there a plan for their resolution? Given these remaining issues, is product development warranted at this time? If so, what is the justification? Is the field test plan adequate? Will it satisfy criteria? How many field test units are needed to verify technical specifications? What is the duration of the tests? To what degree has the prototype met technical product specifications in the laboratory or field experiment?
Legal / Contractual		
Environmental, Safety, other Risk Assessments/ Quality Plans	Perform appropriate elements of the quality plan.	What critical risks remain? Have any new risks been identified? What are the plans for their resolution? Is there justification to proceed before solving critical remaining risks? What is the justification?
Strategic	Identify related projects by other public and private organizations.	How well is this project coordinated to related state, federal, and national R & D programs?
Production Readiness/ Commercialization	Provide evidence of financial stability and capability of the commercializer to produce the product. Obtain commercialzer's binding commitment to proceed. Develop the preliminary production readiness plan, including the critical production process, equipment, facilities, and person-power needed to produce a commercially viable product.	Has the status of the commercializer's financial stability changed and, if so, has it impacted on their ability to commercialize the product? What are the critical commercialization risks? Is the product as envisioned manufacturable at product cost goals? Is the commercializer genuinely committed to commercialze the product, given successful stage 5-7? Is the preliminary production readiness plan adequate?
Public Benefits/ Costs	Estimate PIER costs to completion.	How confident are we in the latest assessment of market impact and public benefits? What is the current estimated PIER program coast to complete the effort? Have the PIER cost estimates changed, and if so, in what direction and magnitude?

Discipline	Stage 5 Product Development And Field Testing	Gate 5 Demonstration Initiation
Marketing/ Connection to the Market	Compare prototype performance with customers' requirements. Gage customer reactions to the product. Implement any changes needed based on field tests to marketing portion of production readiness plan.	How satisfied were the customers? To what degree will the final product specifications exceed customer satisfaction requirements?
Engineering/ Technical	Field-test the product. Develop a demonstration plan (for stage 6). Refine product technical specifications taking into account customer input and field tests.	How well did the product meet the field test criteria? How well did the product satisfy RAMD requirements? If not, what is the plan for their resolution? Is there justification for proceeding despite? Is the demonstration plan adequate? How many units will be tested? Is that number justified? What is the duration of the tests? Is there justification for proceeding despite the remaining technical issues? What is the justification?
Legal / Contractual		Is the system in place to collect sales data from the commercializer?
Environmental, Safety, other Risk Assessments/ Quality Plans	Resolve outstanding regulatory issues. Obtain rulings from regulatory and codes/standards bodies, if needed.	Are there any remaining risks that can be mitigated by demonstration testing? If so, what are they and what is the plan for their resolution?
Strategic		
Production Readiness/ Commercialization	With the commercializer, prepare the refined production readiness plan.	Is the commercializer or user(s) willing to provide match funding for the demonstration testing? Is the commercializer in the process of obtaining financial support for manufacturing the product? Is the refined production readiness plan acceptable to the PIER Program and the commercializer?
Public Benefits/ Costs	Identify public interests, if any, for demonstration testing.	Is it in the public interest to conduct demonstration testing with PIER funds?

Discipline	Stage 6 Demonstration and Full-Scale Testing	Gate 6 Idea Selection and Work Statement Initiation
Marketing/ Connection to the Market	Gage customer reactions to the demonstration tests. Implement any changes needed to marketing plan based on the demonstration test results and market reaction.	What are the plans for technology transfer to get RD & D results into the right hands?
Engineering/ Technical	Conduct and complete demonstration projects. Develop final product specifications taking into account customer input and demonstration results.	Is the product "production ready"? Did it demonstrate efficiency, cost, emission and other product specifications?
Legal / Contractual		
Environmental, Safety, other Risk Assessments/ Quality Plans	Resolve any remaining regulatory issues.	What product regulatory roadblocks have been resolved? What are the remaining roadblocks and what actions need to be taken to resolve them?
Strategic		Where is the appropriate fit in the CA emerging technologies support framework (e.g., AB 1890 renewables and energy efficiency)? Is there a fit? Do these programs recognize and support this product?
Production Readiness/ Commercialization		Are there any financing or investment issues remaining? Is the product as specified manufacturable within cost goals in the product specifications? At what production levels? To What degree are these levels compatible with market impact and benefits analyses? Is the commercializer committed to proceed to full-scale production? If not, what steps are necessary or what barriers must be removed to gain the commitment?
Public Benefits/ Costs		To what degree do public benefits continue to outweigh costs? Are there appropriate public benefits to justify further public funding on market transformation for this product? What is the appropriate private vs. public investment, given public and private benefits at this gate?

Discipline	Stage 7 Demonstration and Full-Scale Testing	Gate 7 Idea Selection and Work Statement Initiation
Marketing/ Connection to the Market	Resolve marketing barriers (e.g., lack of technical and market information to engineers, designers, architects, owners and other key decision makers).	Are there any changes necessary to the marketing plan?
Engineering/ Technical	Resolve technical barriers (e.g. education and tools for engineers, architects, and designers).	Have any new technical issues arisen with the production version? What is the plan for their resolution?
Legal / Contractual	Resolve warranty issues.	
Environmental, Safety, other Risk Assessments/ Quality Plans	Resolve environmental, safety, and other risk issues.	What product quality issues are yet to be resolved?
Strategic	Resolve distribution, service, and other infrastructure issues.	To What degree will distribution and service infrastructure be in place? Is this product in the commercializer's strategic and business plans?
Production Readiness/ Commercialization	Implement detailed manufacturing process and plant layout specifications (commercializer funded). Resolve manufacturing issues.	To what degree is the manufacturing infrastructure in place?
Public Benefits/ Costs		

Discipline	Stage 8 Demonstration and Full-Scale Testing	Gate 8 Idea Selection and Work Statement Initiation
Marketing/ Connection to the Market	Distribute project literature. Conduct customer workshops, focus groups. Assess customer satisfaction. Complete sales staff training. Evaluate possibilities for product spin-off and enhancements.	To what degree are customer needs being met by the product? Are there new needs, new market segments? What are they? What new needs or markets can be addressed in spin-offs?
Engineering/ Technical	Provide engineering and technical support.	Are there any field problems from production units that require added R&D? Is this a private or public issue?
Legal / Contractual		Have royalty goals been met?
Environmental, Safety, other Risk Assessments/ Quality Plans	Monitor Product quality.	Are production units meeting environmental and safety goals?
Strategic	Allocate funds to distribution and service.	Are changes necessary, or streamlining needed, for Commission gates, stages, and other process? What are they? What lessons have been learned? What will we do differently next time?
Production Readiness/ Commercialization	Launch product. Initiate production. Monitor product costs.	Have product manufacturing cost goals been met? Are sales data available? Can they be used to augment PIER program benefits data?
Public Benefits/ Costs	Track sales. Calculate benefits to electric ratepayers.	To what degree has the product achieved estimated benefits and market impacts?

Energy Innovations Small Grant (EISG) Program

Proposals submitted to the EISG Program, to be competitive, need to show evidence that Stages 1 and 2 have been completed with the primary focus of the project to establish technical feasibility associated with Stage 3. Upon completion of an EISG research project, the EISG Program Administrator will perform an independent development stage assessment to determine the degree to which the project has satisfied each of the activities associated with Stage 3. This assessment will be based on information delivered during the performance of the project and the Final Report. EISG projects that intend to seek follow-on funding through PIER need to successfully complete Stage 3 engineering/technical objectives and show coordinated development in the remaining activities for Stage 3 to remain competitive. The EISG Program Manager at the Commission will serve as the Gatekeeper for the EISG Program.

The Stages and Gates Activity Matrix below is used by grant applicants to graphically represent where they are currently and where they will be if awarded a grant. When completed the matrix should look like a horizontal bar chart. Cells can be partially filled in to represent the degree to which the activities associated with that cell are completed. Each rating in the matrix should be supported by an itemized list of points that support the rating. The EISG Program Administrator will use the same matrix to document its independent assessment.

Stages and Gates Activity Matrix

Stages / Activity	1 Idea Generation	2 Technical & Market Analysis	3 Research	4 Technology Develop-ment	5 Product Develop-ment	6 Demon-stration	7 Market Transfor-mation	8 Commerciali zation
Marketing/ connection to the Market								
Engineering / Technical								
Legal/ Contractual								
E&S Risk Assessment/ Quality Plans								
Strategic								
Production Readiness/ Commercia-lization								
Public Benefits/ Cost								